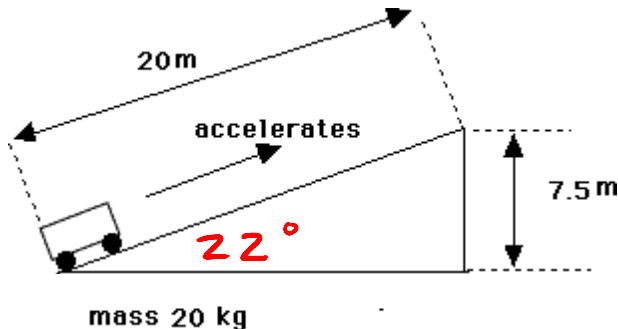


**Example #9:** Here there is a  $22^\circ$  slope. The cart starts from rest at the bottom of the ramp and accelerates to  $4.0 \text{ m/s}$  by the time it reaches the top of the ramp. With a coefficient of friction  $\mu = 0.21$ , how much power was developed?



→ find  $t$ :

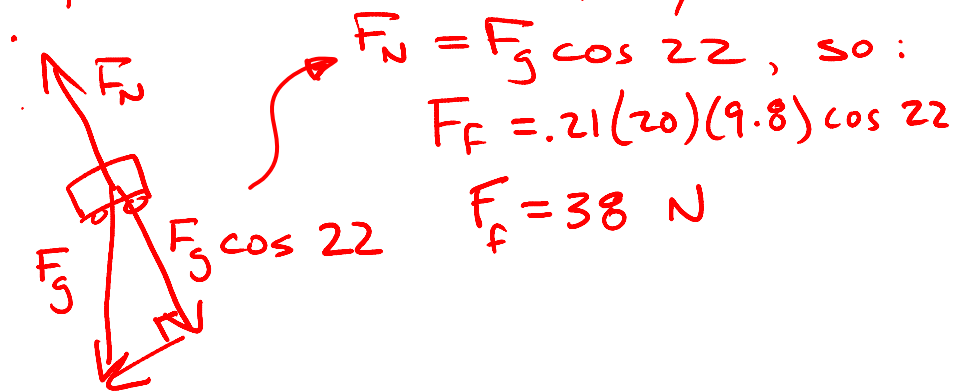
$$d = \left[ \frac{v + v_0}{2} \right] t$$

$$20 = \frac{4}{2} t$$

$$t = 10 \text{ s.}$$

Work is done against gravity, inertia, & friction.

→ find friction:  $F_f = \mu F_N$



$$\Rightarrow P = \frac{\Delta E_k + \Delta E_p + F_f d}{t}$$

$$= \frac{\frac{1}{2} (20) [4^2 - 0] + 20(9.8)(7.5) + 38(20)}{10}$$

$$P = 2.4 \times 10^2 \text{ W}$$